MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

BDE 2014 – DIFFERENTIAL EQUATIONS

(All Sections / Groups)

01 MARCH 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 2 pages.
2. Attempt all 4 questions. The distribution of marks for each question is given.
3. Students are allowed to use scientific calculators.
4. Please write your answers in the **Answer Booklet** provided.

Question 1 [Total = 25 marks]

a) Classify the following differential equations according to order and linearity:

(i) $x^2 \sin x - (\cos x)y = (\sin x)\frac{dy}{dx}$

(ii) $3\frac{\partial^2 u}{dr^2} - 2r\frac{\partial u}{\partial r} + u + 7 = 0$

(iii) $\sqrt{1-y}\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} = 0$

[6 marks]

b) Solve the following differential equation:

$$2y\frac{dy}{dx} = \frac{x}{\sqrt{x^2-16}} \quad \text{where} \quad y(5) = 2$$

[8 marks]

c) (i) Is the differential equation(DE) $\frac{dy}{dx} = \frac{2x^4 + 2y^4}{xy^3}$ homogeneous? Show the proof.

(ii) Hence, solve the above DE using the separable equation method.

[11 marks]

Question 2 [Total = 25 marks]

a) For the following differential equation:

$$(4x - y)dx + (6y - x)dy = 0$$

(i) Show that the differential equation (DE) is exact.
(ii) Find the solution to the exact DE.

[10 marks]

b) Solve the given differential equation by **undetermined coefficients-superposition approach:**

$$2y'' + 4y' + 7y = x^2$$

[15 marks]

Continued...

Question 3 [Total = 25 marks]

a) Consider the following differential equation (DE):

$$2xy'+y=10\sqrt{x}$$

(i) Rewrite the DE in the form of $\frac{dy}{dx}+p(x)y=r(x)$.

(ii) From (i), find its integrating factor.

(iii) Hence, find the general solution of the DE.

[10 marks]

b) Find the general solution for the following non-homogenous **Cauchy-Euler** equation by using **variation of parameters method**:

$$x^2y''-2xy'+2y=x^3e^x$$

[15 marks]

Question 4 [Total = 25 marks]

a) Classify the following partial differential equations as hyperbolic, parabolic, or elliptic.

(i) $\mu_{xx}+2\mu_{xy}+\mu_{yy}+3\mu_x-4\mu_y=0$

(ii) $\mu_{xy}-\mu_{yy}-5\mu_x=6$

(iii) $-\mu_{xx}-3\mu_{yy}-4\mu_y=2$

[9 marks]

b) Find the partial differential equation by eliminating the arbitrary constants from the relation

$$(x-a)^2+(y-b)^2=2z$$

[7 marks]

c) Solve the following partial differential equation

$$\frac{\partial^2 z(x,y)}{\partial x^2}-3\frac{\partial z(x,y)}{\partial x}-4z(x,y)$$

subject to the condition x=0, $\frac{\partial z}{\partial y}=1$ and $\frac{\partial z}{\partial x}=-1$.

[9 marks]

End of paper